Introduction

This report documents the evidence I gathered in relation to some of the Australian Professional Standards for Teachers (APST) during my second practicum. The report serves as part the requirement for teachers to develop a professional portfolio of evidence supporting claims against each of the APST at Graduate level, and identify personal goals in relation to the standards (Australian Institute for Teaching and School Leadership , 2011)**.** This evidence will be presented throughout two sequences of three lessons (exclusive of the first observation lesson). with a Year 9 Stage 5.2 Mathematics class. Whilst a range of APST descriptors will be covered throughout the report, the reader's attention should also be devoted to the assessment-centric approach taken to inform my teaching (see Figure 1 below). The philosophy underpinning this approach is directly in line with that of Hattie's (2009) *Visible Learning*, which adopts the view that teachers are agents of change who must intervene in calculated and meaningful ways to guide their students to achieving learning goals.

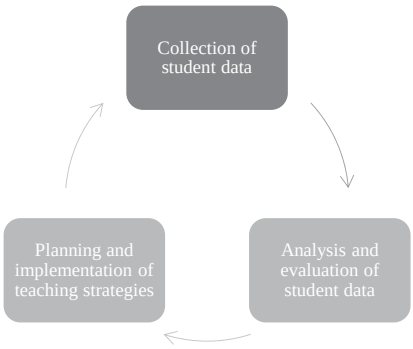


Figure 1 An assessment-centric approach to teaching

Lesson 1: Observation lesson

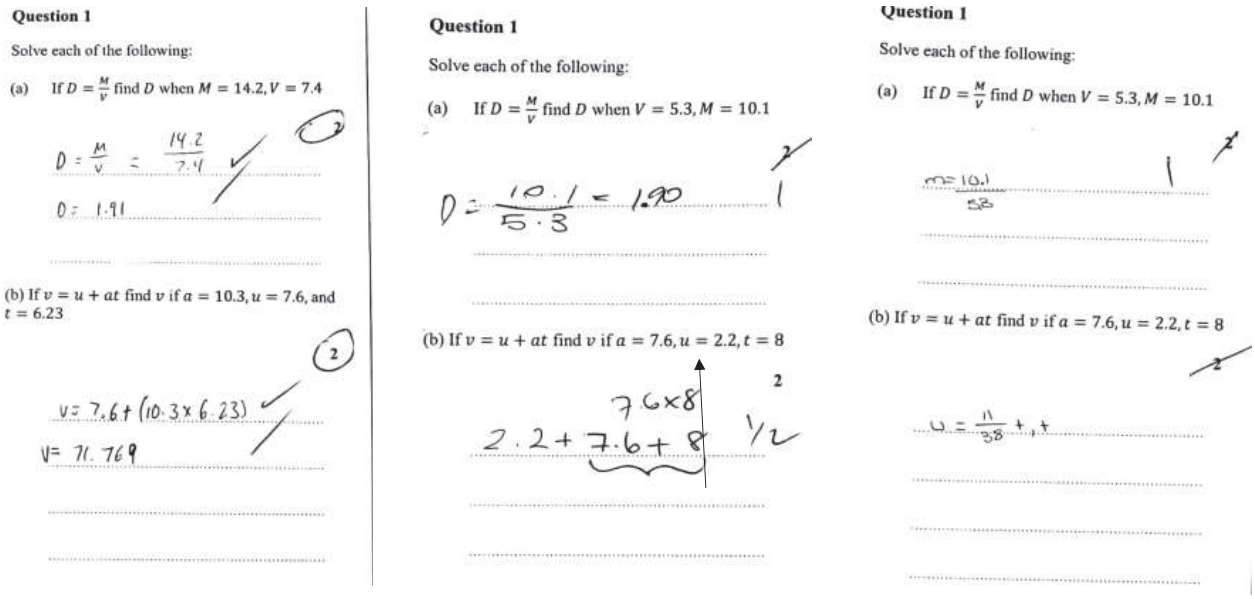


Figure 2 A, C and E student samples from post-test.

5.4 Use student assessment data to analyse and evaluate student understanding of subject/content, identifying interventions and modifying teaching practice

Prior to my first teaching lesson, I produced a diagnostic test to be administered at the end of my Supervising Teacher's lesson to gather evidence on students' learning to date. Diagnostic testing serves the purpose of finding out what the learner knows, determining where they are going and planning for how they will get there (Hattie & Timperley, 2007).

3.6 Evaluate personal teaching and learning programs using evidence, including feedback from students and student assessment data, to inform planning

A, C and E samples were taken from students, with the majority of students falling into the C and E categories. Many students did not know what they were being asked to find the value of the pronumeral. Furthermore, many students incorrectly carried out the substitutions. Observations during the class also revealed that numeracy and literacy may be an issue. The Unit of Work below illustrates my planning in response to these observations.

The data gathered from my classroom observations, discussions with my supervising teacher and the student samples in figure 2 above informed my development of a new Unit of Work for the topic to replace the existing Unit of Work supplied by the school. The Unit also contains the content and how I intend to teach it and draws a direct link between each lesson and the target syllabus outcomes.

Unit of Work: Formulae and Problem Solving	
Aim For students to develop problem-solving skills and see mathematics as a language by using algebra and equations to model and solve worded problems.	**Unit Length** 6 × 45-minute less
Syllabus Outcomes • Selects appropriate notations and conventions to communicate mathematical ideas and solutions MA5.2-1WM • Interprets mathematical or real-life situations, systematically applying appropriate strategies to solve problems MA5.2-2WM • Constructs arguments to prove and justify results MA5.2WM • Solves linear and simple quadratic equations, linear inequalities and linear simultaneous equations, using analytical and graphical techniques MA5.2-8NA	**Mathematical Pro** • Fluency an the subject • Problem so introducing critically a • Understanc
Literacy • Metalanguage – 'linear equation', 'quadratic equation', 'pronumeral/variable', 'substitution', 'y-axis and x-axis' 'make the subject of', 'sketch the graph of …', 'expression', 'formula' • Explicit instruction: 'Let … then … so … therefore …' • Discuss misconceptions such as the difference between 4 ÷ 2 vs. 2 ÷ 4	**Numeracy** • Analysing • Relational understanding of equations
ICT & Resources • Geogebra to model relationship between area and width of a rectangle; Mathletics • Compound assessments • Powerpoints and worksheets	**Strategies** • Explicit instruction: 'I do, we do, you do' • Quality student samples • Faded and compounded examples • Authentic tasks and Polya questioning

2.5.1 Develops lesson plans, observation notes and discussion about lesson content and structure that show knowledge of a range of teaching strategies to support literacy and numeracy development

Literacy and numeracy development is supported via the use of explicit instruction to teach the metalanguage and metacognition throughout the topic (Hattie, 2009). In addition, the use of acronyms are incorporated to support students' numeracy by assisting their development of problem-solving schema (Woolfolk & Margetts, 2015).

The strategies for literacy and numeracy are intended to address the difficulties evident from the student samples in figure 2 above. A combination of clear meaning from literacy strategies and clear structure from numeracy strategies will equip students with the skills required for problem solving.

Figure 3 Unit of Work

Lessons	Syllabus Content and Considerations	Teaching, Learning and Assessment
1	Use algebraic symbols to represent mathematical operations written in words and vice versa • The order of operations can be confused, e.g. '3 less than 5 means 5 – 3'. Similarly, divide 6 by 2 is different to 2 divided by 6 • Use of brackets for the purposes of PEMDAS, e.g. 'divide the sum of 3 and 2 by 5' Translate from everyday language to algebraic language and vice versa • Use algebraic symbols to represent situations described in words, e.g. write an expression for the number of cents in x dollars • Interpret statements involving algebraic symbols in other contexts	The aims of this lesson are to: • Establish ground rules for setting out, homework and behavior via explicit instruction and quality samples • Motivate the topic – the language of mathematics and generalising arithmetic • Use a concept map and glossary sheet to review the terms used to represent $+, -, \times$ and $\div$ o In the glossary, include examples to emphasise PEMDAS and literacy implications for ordering • Use worked examples with the 'I do, we do, you do' model
2	Create algebraic expressions and evaluate them by substituting a given value for each pronumeral Substitute into [illegible] ...essions and ...ula ...are values of x^2 for ...same magnitude ...mphasising use of	The aims of this lesson are to: • Assess for learning of content in prev • Model how to correctly demonstrate writing and executing the substitutio to evaluate the subject of a formula you do' • Provide samples for students to understand why they must use brackets for substitution of negative quantities and square terms

3.2.2 Plan and implement well-structured learning and teaching programs or lesson sequences that engage students and promote learning

This Unit includes a range of teaching considerations and strategies that were selected to engage and promote student learning. The strategies are selected so that they are appropriately aligned with the content. For instance, concept mapping through a class discussion is used to review the concepts of basic operations; glossaries and acronyms are used to support students' literacy by encouraging elaborative rather than maintenance rehearsal to increase the likelihood of long-term memory storage (Sweller, 1994).

2.2.2 Organise content into coherent, well-sequenced learning and teaching programs

Content outcomes from the syllabus are divided and allocated into a "lesson itinerary" to give direction for teachers and students. The sequencing of each lesson orders the syllabus content outcomes in a logical fashion. For example, students are taught to become familiar with algebraic symbols before using them to evaluate for missing pronumerals.

3	Substitute values into formulas to determine an unknown • Solve equations arising from substitution into formulas, e.g. $P = 2l + 2b$ and $P = 20$, $l = 6$, find b • Solve problems and interpret solutions, e.g. $A = \frac{1}{2}xy$, $v = u + at$, $C = \frac{5}{9}(F -$	The aims of this lesson are to: • Assess for learning of content in previous lesson • Model how to make a pronumeral the subject of an equation 'I do, we do, you do' • Use an authentic substitution problem and provide students with a real-world context for problem-solving. • Use student samples to demonstrate
4 and 5	Solve problems involving linear equations, including those derived from formulas • Translate word problems into equations, solve the equations and interpret the solutions o State clearly the meaning of introduced pronumerals when using equations to solve problems, e.g. 'n = number of years o Solve word problems involving familiar formulas, e.g. 'if the area of a triangle is 30 square centimetres and the base length is 12 centimetres, find the perpendicular height of the triangle	The aims of these lessons are to: • Assess for learning of content in previous lessons • Use compounding/faded examples to model the DESE (data, equation, substitution, evaluation) model using 'I do, we do, you do' o Make instruction explicit with regards to defining pronumerals and writing full sentences in responses.

Figure 3 Unit of Work

Lessons 2 and 3 (Double period)

Lesson Details			
Teacher Education Student	[redacted]	**School**	
Lesson Duration	100 minutes	**Year/Class**	9 Mathematics 5.2
Curriculum Area	Mathematics	**Topic**	Formulas and Problem Solving
Lesson Title/Focus	Equations arising from Substitution		
Syllabus Outcomes	Substitute values into formulas to determine an unknown • Solve equations arising from substitution into formulas, e.g. $P = 2l + 2b$ and $P = 20$, $l = 6$, find b • Solve problems and interpret solutions, e.g. $A = \frac{1}{2}xy$, $v = u + at$, $C = \frac{5}{9}(F -$ 32)		
Lesson Intentions	Students can perform substitutions accurately Students can find specific pronumerals in a given formula.		
Assumed knowledge	Some familiarity with substitution Familiar with terms such as pronumeral, substitution and equation Some basic algebra conventions such as $ab = a \times b$ and $\frac{a}{b} = a \div b$		
Differentiation	Exercises will be graded by difficulty		
Focus for literacy	Terminology: pronumeral, substitute, the subject		
Focus for numeracy	Formulas arising in the real world such as area of triangle, simple interest and perimeter will be discussed		
Focus for ICT	N/A		
Resources and WHS	Powerpoint Signpost 5.1-5.2		

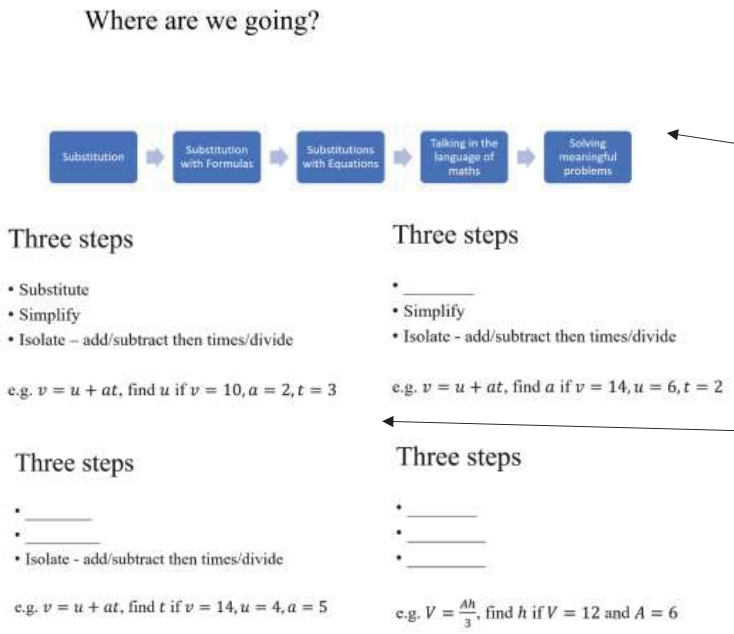
2.1.1 Clearly articulates and explains the central concepts of the subject, linking the content, outcomes and activities to key syllabus documents

The lesson intention is directly drawn from the syllabus outcomes and articulated in a manner that is understandable to both teachers and students. Specific examples prescribed by the syllabus are also identified and addressed within the lesson plan.

Teaching and Learning Sequence			
Timing	**Teacher does and says**	**Students do and say**	**Assessment & feedback**
Introduction (10 minutes)	T clarifies learning intention with S' using a flow chart T encourages S' to ask Qs about the purpose/direction of the topic	May ask questions or make comments to clarify the learning intentions	S comments/questions can be used to adjust how learning goals are presented

Body (80 minutes)	T provides explicit instruction for substitution involving equations: 1) Substitute 2) Simplify 3) Isolate using opposite operations T uses **faded and compounding** examples: $v = u + at$ Find u, a and t $V = \frac{Ah}{3}$ Find A, h $K = \frac{1}{2}mv^2$ Find m, v $A = \frac{1}{2}h(x + y)$ Find h, x, y T directs student to the exercises (11:04 Q1 – 4 – stick to Qs with whole numbers only) and ANY one question from 6, 7 or 8. T directs S' to Mathletics assessment.	S' write down examples S' ask questions and can make comments S' attempt some problems on their own	Frequency counts and time sampling to measure student engagement T should actively monitor for students' understanding by asking questions and checking their work T uses 'no hands up' questioning to ensure that evidence of learning is drawn from a more reliable cross-section of students Corrective feedback can be obtained by drawing on the ideas of other students in the class
Conclusion (10 minutes)	T concludes the lesson by reviewing key concepts learned	S' begin on exercises S' may ask questions for clarification	S' responses during the review can be used as a rough gauge for understanding of content.

Figure 4 Lessons 2 and 3 (Plan)



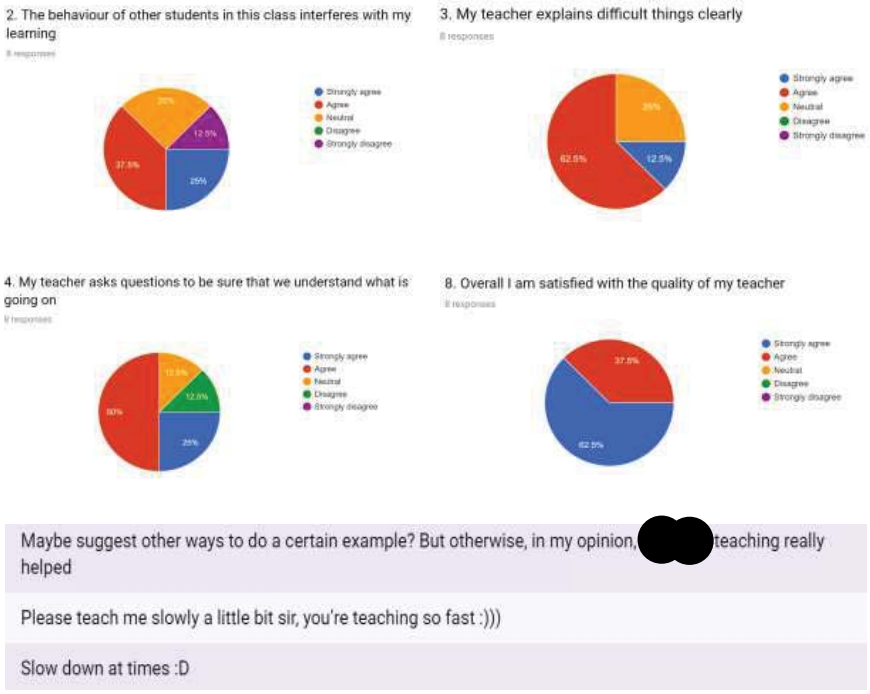
3.1.1 Communicates clear and appropriate learning goals, taking into account syllabus and student diverse learning needs and continually evaluates student progress against these goals

The goals and sequencing I constructed in the Unit of Work was communicated to students in a succinct and coherent manner via a flow chart to ensure that every student had a clear understanding of the long-term learning intention (William & Leahy, 2015). The short-term goals were communicated verbally to students against the backdrop of these long-term goals.

3.3.1 Uses an extended range of teaching strategies and adapts them while teaching in response to changing needs of the students

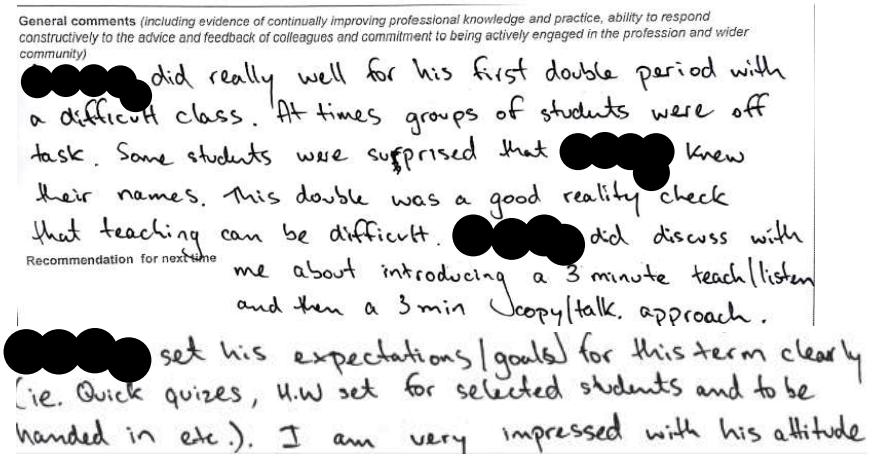
Explicit instruction was combined with faded examples in response to the data from lesson 1, which indicated that the students were still novice learners who were still developing the relevant schema (Kissane, Kalyuga, Chandler, & Sweller, 2008).

Figure 5 Explicit Instruction and Faded guidance



In addition to value-added data, I sought feedback from both my Supervising Teacher and the students. Both the Supervising Teacher's comments and students' responses indicated that off-task behaviours in the class were an issue that still needed to be addressed. However, my Supervising Teacher did recommend that I continue implementing the timer rule as it was effective with the class.

Moreover, he students' responses indicated that whilst the explanations were clear, the pace needed to be reduced. Interestingly, one student comment requested that I showed students alternative ways of doing an example. This gave me the idea of incorporating differentiation strategies in my teaching, which could satisfy both of these requests from students.



Lesson 4

Lesson Details			
Teacher Education Student	[redacted]	**School**	
Lesson Duration	50 minutes	**Year/Class**	9MA5.2
Curriculum Area	Mathematics	**Topic**	Formulas and Problem Solving
Lesson Title/Focus	Translating problems into equations		
Syllabus Outcomes	Translate from everyday language to algebraic language and vice versa • Use algebraic symbols to represent situations described in words, e.g. write an expression for the number of cents in x dollars o Interpret statements involving algebraic symbols in other contexts Solve problems involving linear equations, including those derived from formulas • Translate word problems into equations, solve the equations and interpret the solutions		

	○ State clearly the meaning of introduced pronumerals when using equations to solve problems, e.g. 'n = number of years' Solve word problems involving familiar formulas, e.g. 'if the area of a triangle is 30 square centimetres and the base length is 12 centimetres, find the perpendicular height of the triangle
Lesson Intentions	For students to be able to recognise the following: Sum, add → + Subtract, take away, take from, minus → − Divide, share, split → ÷ Lots of, multiply, product → × Students use Algebra to express relationships
Assumed knowledge	Sum, add → + Subtract, take away, take from, minus → − Divide, share, split → ÷ Lots of, multiply, product → × Basic literacy
Differentiation	Open questioning and brainstorming to accept a wide range of responses; graded problems
Focus for literacy	Terminology '3 -2' can be written as '3 take away 2' or 'Take 2 from 3' - Oracy
Focus for numeracy	Students develop their numeracy as they solve problems by framing a problem mathematically.
Focus for ICT	N/A
Resources and WHS	Prescribed text – 11:01 Powerpoint

The next lesson was planned with data from the prior lesson in mind. Thus, there is emphasis on differentiation, continued use of worked examples and scaffolding and the 3-minute routine as a classroom management strategy.

Teaching and Learning Sequence			
Timing	**Teacher does and says**	**Students do and say**	**Assessment & feedback**
Introduction (15 minutes)	**3-minute timer routine used throughout** T brainstorms mathematical words for $+, -, \times, \div$ T applies these to concrete examples and then increases abstraction. E.g. The sum of 3 and 4 is… The sum of x and y is … T starts a class discussion with open-questioning (True of False and why?) • $4 - 3$ is not $3 - 4$ • $4 \div 2$ is not $2 \div 4$	S' contribute to the class discussion and add to the brainstorm S' explain their solutions to the class verbally.	T assesses S' literacy through verbal and written responses T gives verbal and written corrective feedback S' responses will inform need for T to give explicit instruction for literacy S' give teacher a thumbs up or thumbs down to indicate understanding
Body (25 minutes)	T sets the following problems: 11:01 Qs 3 – 8, 10, 12, 16, 17 Challenge – Qs 15 and 18 T marks the roll	S' begin on problems S' ask questions for clarification	T actively monitors to manage behaviour and provide assistance and feedback by checking S' work T gauges S' understanding based on their progression through the exercise
Conclusion (10 minutes)	T gives a post-test (quick quiz)	S' set reminders for their quizzes and	N/A

3.5.2 Use effective verbal and non-verbal communication strategies to support student understanding, participation and engagement

Students are provided feedback from myself and their peers through verbal descriptions of mathematical sentences. Non-verbal strategies such as thumbs up/thumbs down is used to gauge for class-wide understanding and serves as feedback for me to adapt my teaching practice. Corrective feedback was used for small or subtle errors such as incorrect grammar. In these instances, delivery of corrective feedback was subtle (e.g. rephrasing).

Figure 8 Lesson 4 (Plan)

Lesson 5

Lesson Details			
Teacher Education Student	[redacted]	**School**	[redacted]
Lesson Duration	50 minutes	**Year/Class**	9 Mathematics 5.2
Curriculum Area	Mathematics	**Topic**	Formulas and Problem Solving
Lesson Title/Focus	Translating problems into equations		
Syllabus Outcomes	Solve problems involving linear equations, including those derived from formulas • Translate word problems into equations, solve the equations and interpret the solutions o State clearly the meaning of introduced pronumerals when using equations to solve problems, e.g. 'n = number of years' Solve word problems involving familiar formulas, e.g. 'if the area of a triangle is 30 square centimetres and the base length is 12 centimetres, find the perpendicular height of the triangle		
Lesson Intentions	Students learn to convert worded problems into equations (one and two-step) Students review how to solve equations Students learn to interpret their solutions		
Assumed knowledge	All content covered in the unit thus far – substitution, generalised arithmetic, making a pronumeral the subject		
Differentiation	Problems will be graded by difficulty Various amounts of scaffolding		
Focus for literacy	Defining pronumerals (e.g. Let n be the number of ...) Writing sentences to explain working (Let ... then ... therefore ...)		
Focus for numeracy	Students will learn to transfer these problem-solving skills to real-world contexts by converting everyday problems into equations		
Focus for ICT	N/A		
Resources and WHS	Powerpoint Prescribed text		

Teaching and Learning Sequence			
Timing	**Teacher does and says**	**Students do and say**	**Assessment & feedback**
Introduction [15 minutes]	T displays a roadmap of S' learning: substitution → formulas → generalised arithmetic → **solving meaningful problems** T briefly reviews simple substitutions T briefly reviews terms for $+, -, \times, \div$	S' participate to the review S' take down notes from the review PPT	T uses questioning to elicit evidence of learning T provides corrective feedback by drawing on the input of other S' in the class
Body + Conclusion [35 minutes]	T gives S' the following problem-solving steps: 1) Operations 2) Equation – let the mystery number by x 3) Solution Examples – T uses e.g's supplied in the text, prompts above are faded along the way T marks roll T sets exercise problems – 11:05 Q's 1 – 7 (E.S.P) T administers quick quiz	S' take down notes from the PPT S' contribute to the class discussion S' ask questions and make comments for clarification S' begin on exercise problems Students complete quiz	T uses questioning to elicit evidence of learning T provides corrective feedback by drawing on the input of other S' in the class T should use 'no hands up' and call out names to assess for understanding

Review is used as an opportunity to address misconceptions from last lesson.

Figure 11 Lesson 5 (Plan)